

SERVICE MANUAL RASR SM 07 FOR BELTED AIRSPRING ASSEMBLIES



Air Springs for IR Coaches

- ▶ EMU/DEMU 180 kN
Code: RASR 845 N. 100 P 02
RDSO: STR No. C-K 406
- ▶ MEMU 150 kN
Code: RASR 747 N. 100 P 10
RDSO: STR No. C-K 106
- ▶ MAIN LINE 140 kN
Code: RASR 747 N2 100 P 11
RDSO: STR No. C-K 106
- ▶ LHB-Fiat 120 kN
Code: RASR 747 N3 100 P 16
RDSO: STR No. C-K 508



EMU/DEMU - 180 kN



MEMU - 150 kN



MAIN LINE - 140 kN



LHB - FIAT 120 kN

From
RESISTOFLEX
SINCE 1947

In collaboration with
Continental
CONTITECH

RESISTOFLEX DYNAMICS PVT. LTD.

Mktg: B - 103, SECTOR - 5, NOIDA - 201 301 Email: sales@resistoflex.in Tel: (0120) 242 0321 - 322 - 315 Mob: 9818200361 - 365 Fax: (0120) 242 1417

INSTRUCTION

MANUAL

FOR

BELTED

AIR SPRING ASSEMBLIES



INDEX

<u>Chapter</u>	<u>Particulars</u>	<u>Page Nos.</u>
1.	Preamble	3
2.	The Technology – Air Suspension	4 – 6
3.	Installation Instructions	7 – 15
4.	Inspection Requirements	16 – 18
5.	Troubleshooting	19 – 26
6.	Instructions for Removal of Air Spring	27 – 31
7.	Instructions for Reassembly of Air Spring	32 – 38
8.	Handling and Storage of Air Spring	39 - 43
9.	R.D.S.O. approved Air Springs	44

CHAPTER

1

PREAMBLE

In 1956 the first German rail bus was fitted with Conti air spring. Since then air springs have made unstoppable progress in the world of transport. Everywhere in Europe, the United States, Canada, South America, Far East and Australia trains running on urban, suburban and intercity networks provide a comfortable ride thanks to air spring technology. The pinnacle to date of this trend is high speed train traffic for the French high- speed train TGV holding the world speed record for trains ,reaching 515Km/h on the Paris Tours run. Today Air Springs are in widespread use in Trams, Metros, Suburban, EMUs, DMUs and Mainline Coaches because of the various advantages they offer over conventional suspension systems.

Since 1997 Indian Railways have successfully employed Air Suspension Systems in EMUs, DMUs and Freight Cars. Without having to repeat the basic research and development work, this latest technology will benefit Mass Transit and Intercity Coaches. Likewise Hydro Springs which combines a conical rubber adjustable spring and a hydraulic damper in the primary suspension will eliminate maintenance, provide additional comfort, drastically reduce transmission of hum frequencies and jounce and serve as wheel set guidance in modern bogies.

CHAPTER

2

THE TECHNOLOGY OF AIR SUSPENSION

Generally, the entire load of the vehicle is shared by the various springs present in the bogie. These springs provide the required cushioning for the vehicle. When loading on the vehicle varies which invariably happens, the “Ride Height” of that vehicle varies accordingly. It manifests in the form of variation in “Coupling Height” of a train formation. The “Ride Height” of the vehicle is important to maintain parity with the way-side “Platform” level and vehicle floor level.

To maintain “Passenger Comfort” in rolling and pitching, the ride height of the vehicle and the coupling height between vehicles in a formation, an extra cushioning is provided in form of air suspension. The air suspension comprises mainly of two parts

1. Air Spring Assembly
2. Pneumatic Control System to maintain constant height independent of load.

The air suspension is preferred where there is frequent and sudden changes in the loading pattern and also “Passenger Comfort” is called for, on EMUs, DMUs, Rail Bus, Intercity trains etc. The required load proportional braking effort can be given to the vehicle depending upon the particular load present at that instant by introducing an additional valve called averaging relay valve which uses the airflow from the relief valve as a signal.

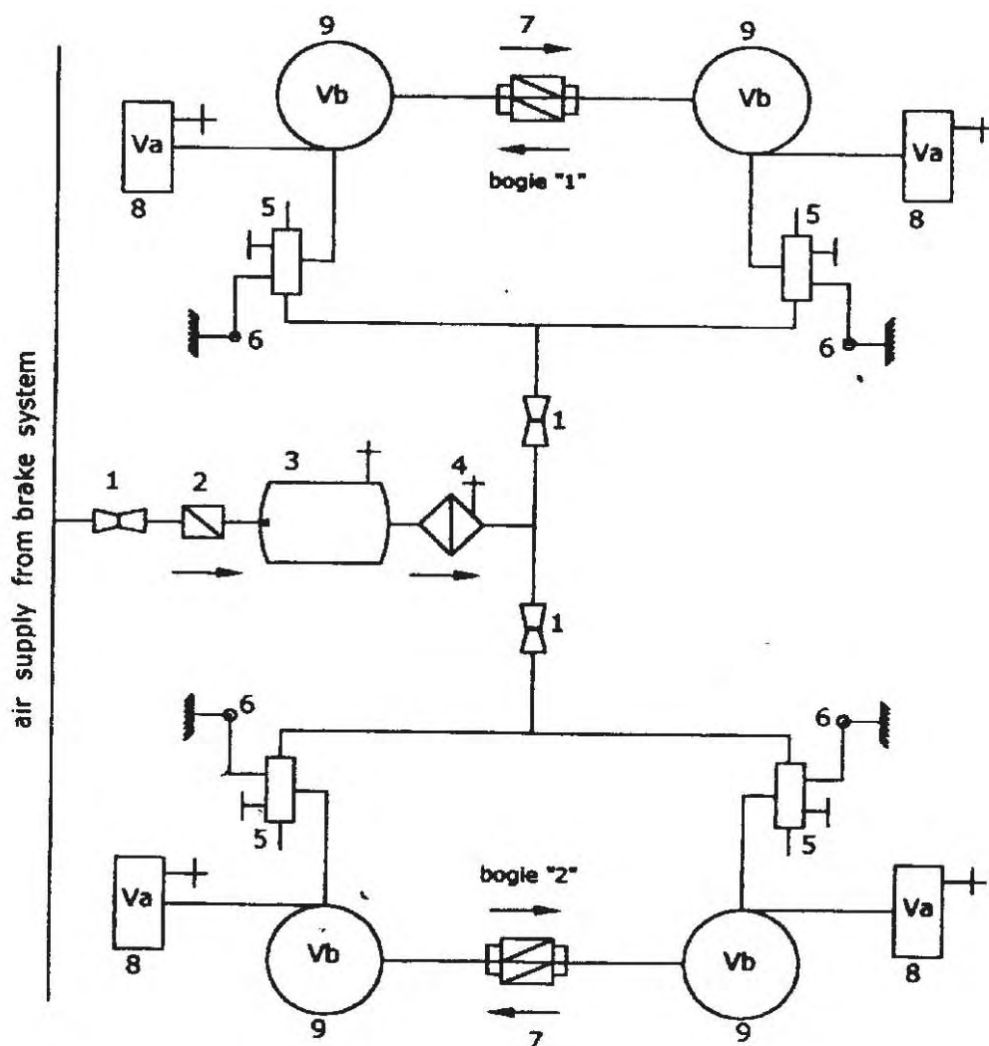
Air suspension are installed as shown in the enclosed sketch, with a 4 point system which as the name suggests have four leveling valves. Four point systems tend to be the accepted norm for high-speed operation allowing individual control of each air spring and hence optimum riding control. The two air springs at one end of the vehicle, are provided with a relief valve which will prevent excessive pressure difference occurring between the air springs.

The nominal height and level of the vehicle is set in the tare condition. Depending upon the evenness of the load spread on the vehicle, each suspension spring will have a slightly different air pressure to maintain this level. Any subsequent increase or decrease in load over any air spring will cause a linear deflection to occur at that point. The leveling valve(s) (Sl. Nos. 5,6 & 7 of the enclosed schematic) will register this movement and increase or decrease the pressure in the air spring (s) as appropriate to bring the vehicle body back to the correct level.

When a vehicle body has two leveling valves, the air springs of a bogie need to be connected together so that if an air spring burst occurs on one side it does not cause a severe tilt or twist. However, if a direct connection was made, then the pressures in each air spring would try to equalise and side to side leveling would not be possible. Also, in trying to level itself, the more lightly loaded side would be exhausting air to try and bring itself to the correct height whilst the more heavily loaded side would be re-feeding the air into the air springs. To prevent this happening they are separated by a Relief Valve (Sl. No. 7 of the enclosed schematic) on that bogie, which only allows air to pass between the air springs when a set differential is attained. This allows the leveling system to perform its function and prevent excess air consumption, whilst allowing both air springs to be deflated to a level where they would rest on their emergency spring should one air spring burst. The pressure differential on the Relief Valve offered is dependent on the coach requirement. This pressure differential is linked to the maximum difference in air pressure that can be seen between the air bags in dynamic conditions plus the collapse pressure of the air bags.

Notes :

- a) The mechanical Pneumatic Control System is generally not in our scope of supply.
- b) An Electronic Control System cum Emergency Warning System based on electronic sensor, electronic valve and a tailored control function has been developed. This allows automatic and close tolerance setting of Air Spring dispensing with any manual setting and associated problems.



S. No.	PART NO.	DESCRIPTION	QTY/COACH
1.	R.IC..	ISOLATING COCK (OLP TYPE)	3
2.	R.AF	AIR FILTER (TWO WAY)	1
3.	R.AR.150L	150L AIR RESERVOIR WITH DRAIN COCK	1
4.	R.CV	CHECK VALVE (NON RETURN VALVE)	1
5.	R.LV	LEVELLING VALVE WITH AIR RESTRICTION	4
6.	R.IL.315	INSTALLATION LEVER (WITH BALL & SOCKET)	4
7 a)	R.DV.1.5	DUPLEX CHECK OVERFLOW VALVE FOR EMU, DEMU, MEMU, MAINLINE, LHB	2
7 b)	R.DV.1.0	DUPLEX CHECK OVERFLOW VALVE FOR COACHING CONTAINER	2
8 a)	R.AR.20L	20L AIR RESERVOIR WITH DRAIN COCK FOR EMU, MEMU, DMU, HLC	4
8 b)	R.AR.40L	40L AIR RESERVOIR WITH DRAIN COCK FOR MAINLINE	4
8 c)	--	NO AIR RESERVOIR FOR LHB	--
9.	RASR	AIR SPRING ASSEMBLY	4

CHAPTER

3

INSTALLATION INSTRUCTIONS
FOR A LEVELLING VALVE
SYSTEM IN AIR SPRUNG
VEHICLES

<u>S.No.</u>	<u>Topic</u>	<u>Page Nos.</u>
1.	Prerequisites and Preconditions	8
2.	Presetting to achieve an identical free gap	9 – 10
3.	Installation Procedure 4 – Point Suspension System	11
4.	Procedure for setting	12 – 13
5.	Important Instructions	14
6.	Air Spring Installation Height Record	15

1. PREREQUISITES AND PRECONDITIONS

The air supply system in the rail vehicle should be designed in such a way that the air feed for each bogie can be adjusted individually by means of a stop cock. What's more in designing the rail vehicle and the car body, care is to be taken that the installation lever of the leveling valves is easily accessible from outside. When the settings are adjusted, the car body has to be supported intermittently in the center by means of a strong block of wood on the bogie (likewise in the center). It is necessary, therefore, that the bogie design also briefly allow, at tare, for imposition of a load in the center.

In the event that the design does not allow the car body to be supported centrally on the bogie. Precise level adjustment requires in any case, that there are fixed points, between the car body and the bogie frame or, if necessary between the bogie and the upper edge of the rail on the basis of which the distance during the adjustment operation can be easily controlled. Usually these points are determined individually for each vehicle or each bogie following manufacturing and appropriately marked on the bogie or vehicle.

ATTENTION :

IN THE EVENT NO MARKINGS CAN BE FOUND ON THE CAR BODY AND / OR BOGIE FRAME, PLANE-PARALLEL SURFACES CAN ALSO BE USED. EVERY IRREGULARITY AND ANY MANUFACTURING TOLERANCES WOULD IMPEDE OR EVEN DISTORT THE SETTINGS HOWEVER. THE FOLLOWING AIDS OR PERSONNEL ARE REQUIRED TO SET LEVELLING VALVES ON A RAIL VEHICLE:

- 1.1 2 pcs block of wood (if need be block of metal) capable of supporting 2/3 of the weight of the car body without major deformation or even destruction. The block must be so dimensioned that the length of at least one edge corresponds to the center distance between the car body and the bogie when the air spring is ready for operation.
- 1.2 2 pcs tape measure or measuring device for determining the height of the car body above the bogie frame or upper edge of the rail.
- 1.3 2 pcs wrench to lock the nuts on the adjusting rods.
- 1.4 2 workers to adjust the valve.
- 1.5 What's more, the whole rail vehicle must be hooked up to a permanent pressure supply system with at least 6 bars of pressure.

2. PRESETTING TO ACHIEVE AN IDENTICAL FREE GAP

While it is not absolutely necessary that the air spring system be preset by means of **SHIMS, USING THEM ENSURE THAT FOR ALL FOUR AIR SPRING SYSTEMS HAVE EXACTLY THE SAME FREE GAP AT TARE.** Because of the manufacturing tolerances in the bogie and in the auxiliary spring, a car body would never be exactly level in an emergency but would exert forces of varying strength on the auxiliary springs. In addition, non uniform load distribution in the car body can give rise to differences in stress and thus to compression of the auxiliary spring in emergencies. All of this leads ultimately to a torsional distortion of the car body and to eventual force variations between the air spring system and the car body and between the wheel and the rail.

THIS IS WHY, IN THE MANUFACTURE OF MODERN RAIL VEHICLES MEASURING UP, IN PARTICULAR, TO THE HIGH DERAILMENT PREVENTION STANDARDS, THE LEVEL OF ALL AIR SPRING SYSTEMS IS EQUALIZED DURING MOUNTING BY THE INSERTION OF SO-CALLED SHIMS ON THE BOGIE. THIS HAS THE EFFECT THAT AN IDENTICAL LEVEL IS ATTAINED FOR ALL AIR SPRING SYSTEM (IN EMERGENCIES).

The following course of action is to be adhered to when presetting the bogies:

- 2.1 If need be, level equalization by means of adapter plates in the primary suspension to offset the manufacturing tolerances in these springs.
=>uniform height and parallel bogie frames.
- 2.2 Placement of the air spring systems on the bogie frame.
- 2.3 On a corresponding pressure testing facility, hydrocylinders are used to subject the air springs (or just the auxiliary springs, as the case may be) to a force exactly equal to the force that would result at this point in the car body at tare. =>Because of the manufacturing tolerances, there will be differences in the distance between the level of upper edge of the rail and the upper edge of the air spring system or the laminated rubber metal spring support.
- 2.4 The air spring systems or the auxiliary spring are lifted off the bogie frame again.

2.5 THE LEVEL DIFFERENCES ARE DETERMINED AND SUFFICIENT SHIMS (STAINLESS STEEL PLATES, FOR EXAMPLE) INSERTED UNDER THE AIR SPRING SYSTEM OR THE AUXILIARY SPRING TO OFFSET THE DIFFERENCES AND ATTAIN A UNIFORM LEVEL.

2.6 PLACE THE AIR SPRING SYSTEMS AND THE AUXILIARY SPRING ON THE SHIMS ON THE BOGIE FRAME AND MOUNT SECURELY.

PLEASE NOTE:

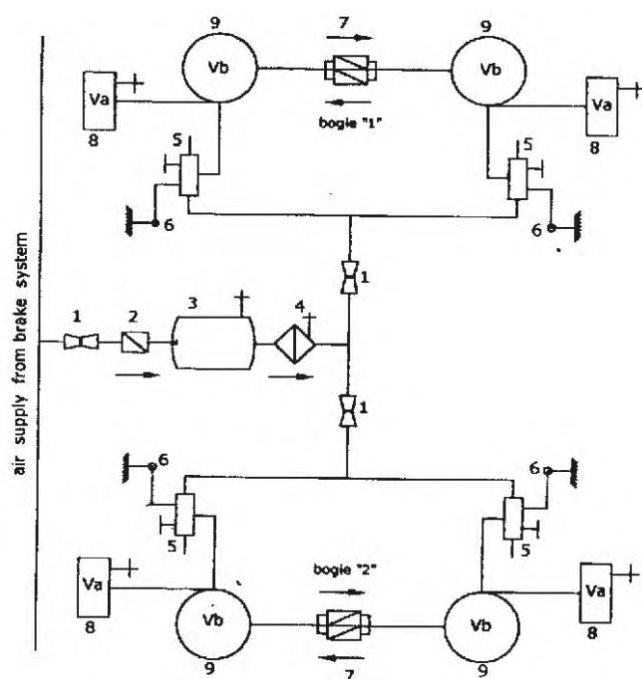
IN DEVELOPING AND DESIGNING THE BOGIE AND THE CAR BODY CARE IS TO BE TAKEN THAT SUFFICIENT OVERALL HEIGHT IS AVAILABLE FOR THE INSERTION OF SHIMS UNDER THE AIR SPRING SYSTEMS.

3. INSTALLATION PROCEDURE

4 POINT SUSPENSION SYSTEM

The 4 point system is a statically defined system that can effect various forces between car body and bogie and thus between wheel and rail as well. A 4 point system guarantees protection from derailing only by respectively equipping each bogie with a double check overflow valve (7) that, depending on its characteristics, allows for certain pressure or force differentials.

The following drawing shows the basic structure of a 4-point system :



S. No.	PART NO.	DESCRIPTION	QTY/COACH
1.	R.IC..	ISOLATING COCK (OLP TYPE)	3
2.	R.AF	AIR FILTER (TWO WAY)	1
3.	R.AR.150L	150L AIR RESERVOIR WITH DRAIN COCK	1
4.	R.CV	CHECK VALVE (NON RETURN VALVE)	1
5.	R.LV	LEVELLING VALVE WITH AIR RESTRICTION	4
6.	R.IL.315	INSTALLATION LEVER (WITH BALL & SOCKET)	4
7 a)	R.DV.1.5	DUPLEX CHECK OVERFLOW VALVE FOR EMU, DEMU, MEMU, MAINLINE, LHB	2
7 b)	R.DV.1.0	DUPLEX CHECK OVERFLOW VALVE FOR COACHING CONTAINER	2
8 a)	R.AR.20L	20L AIR RESERVOIR WITH DRAIN COCK FOR EMU, MEMU, DMU, HLC	4
8 b)	R.AR.40L	40L AIR RESERVOIR WITH DRAIN COCK FOR MAINLINE	4
8 c)	--	NO AIR RESERVOIR FOR LHB	--
9.	RASR	AIR SPRING ASSEMBLY	4

4. PROCEDURE FOR SETTING

Within the possible pressure differences, the car body can, nonetheless, be distorted or, via the respective diagonal, the air springs subjected to higher and then to lower pressure when the car body settings are improperly effected. To minimize the pressure difference, the following course of action is to be adhered to in adjusting the settings:

- 4.1 Place the car body on the two bogies and hook it up to the air supply (by opening the stop cock 1a).
- 4.2 First open only the stop cock (1c0, thereby releasing the air supply for bogie "1", and affix the level control rod assembly to the valves.
- 4.3 On the rod assemblies (6) set the general level (- 5mm) that the car body is ultimately to have above the bogie frame and the upper edge of the bogie.
- 4.4 Insert a suitable block (ca. 10 mm under the nominal height and preferably of hardwood) centrally between the bogie frame and the car body and lower the car body onto the block by removing the valve rod assembly (6).
- 4.5 Shut the stop cock (1c) again, thereby interrupting the supply of air to bogie "1" and open stop cock (1b), thereby releasing the air supply to bogie "2".
- 4.6 Affix level control rod assemblies (6) to the valves (5) and set the assemblies (6) to the desired level.

NOTE : IN THE EVENT THAT THE TARGET HEIGHT IS ALREADY EXCEEDED IN EFFECTING THE SETTINGS, THE ROD ASSEMBLIES ARE FIRST TO BE REMOVED AGAIN BECAUSE OF THE VALVE`S DEADBAND AND THEN SCREWED BACK WITH NO IMPACT ON THE VALVES OF THE ROD ASSEMBLY (6), ONCE THE AIR SPRING SYSTEMS ARE BLED AND THE CAR BODY HAS SETTLED ON THE AUXILIARY SPRINGS, THE ROD ASSEMBLIES (6) ARE TO BE HUNG BACK INTO PLACE AND THE HEIGHT READJUSTED.

- 4.7 Insert a suitable block (preferably hardwood) centrally between the bogie frame and the car body and lower the car body onto the block by removing the valve and assemblies (6).

- 4.8 Shut stop cock (1b) again, thereby cutting off the air supply to bogie "2", and open stop cock (1c), thereby releasing the air supply to bogie "1".
- 4.9 Attach level control rod assemblies (6) to the valves (5) and, after aeration, carefully adjust settings on both rod assemblies (6) simultaneously (proceeding from below) until the desired car body height has been attained.

NOTE : IN THE EVENT THAT THE TARGET LEVEL IS ALREADY EXCEEDED WHEN THE SETTINGS ARE EFFECTED, THE ROD ASSEMBLIES (6) ARE FIRST TO BE REMOVED AGAIN, BECAUSE OF THE DEAD CENTER OF THE VALVES, AND SCREWED BACK WITHOUT IMPACT ON THE VALVES. ONCE THE AIR SPRING SYSTEMS HAVE BEEN BLED AND THE CAR BODY HAS SETTLED ONTO THE AUXILIARY SPRINGS, THE ROD ASSEMBLIES (6) ARE TO BE HUNG BACK IN PLACE AND THE HEIGHT CORRECTED.

- 4.10 Remove the block from bogie "1".
- 4.11 Reopen stop cock (1b), thereby releasing air to bogie "2", while at the same time (!) hanging the rod assembly (6) back in place in bogie "2".
- 4.12 Remove the block from bogie "2".
- 4.13 Recheck the height at all measuring points.

NOTE : IF NO CONSTANT HEIGHT IS ESTABLISHED, ALL FOUR (!) ROD ASSEMBLIES (6) ARE TO BE REMOVED AND SIMULTANEOUSLY HUNG BACK IN PLACE AFTER THE SYSTEMS HAVE BEEN BLED. IN THE EVENT THAT THE LEVEL STILL ISN'T CONSTANT, THE BLOCK IS TO BE INSERTED CENTRALLY UNDER BOGIE "1" AGAIN, STOP COCKS (1B) AND (1C) SHUT TO INTERRUPT THE AIR SUPPLY TO BOTH BOGIES, AND ALL SYSTEMS BLED. ONE MUST THEN PROCEED AGAIN AS INDICATED UNDER POINT.

5. IMPORTANT INSTRUCTIONS

Following points must be taken care of :-

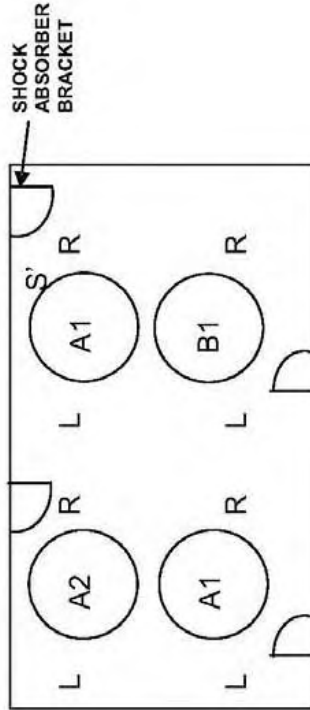
- 5.1 Name plate affixed to the top plate of the Air Spring Assembly must be visible from outside.
- 5.2 Please ensure that only one type of Air Spring make is used in one coach. There should not be any mix up of two different types of Air Spring Assembly in one coach as they will have different characteristics.
- 5.3 Installation height of Air Spring must be as under :-

	<u>Air Spring Assembly</u>	<u>Application</u>	<u>Installation Height</u>
5.3 a)	RASR 747 N3.100 P10	EMU MEMU DEMU CCF	255 260 mm
5.3 b)	RASR 845N.100 P02	EMU, DEMU	
5.3 c)	RASR 747N2.100 P11	MLC	
5.4 d)	RASR747N3.100 P16	LHB	292 294 mm

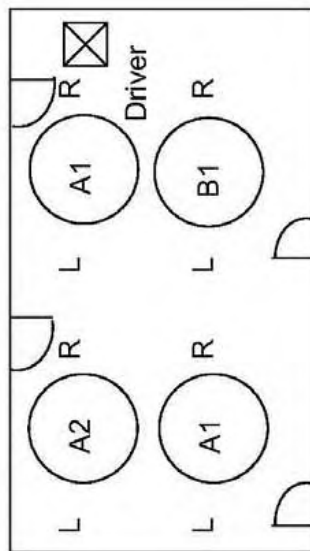
- 5.4 After installation please fill up the RDPL F2 format and return to Resistoflex for our reference and further use.
- 5.5 RDSO has recommended spare. Air Spring Bellows for maintenance of Air Suspension, vide letter No. SV.EMU.RAS dated 21-01-2003 to all GM (Mech) & GM (Elect) of Zonal Railways. Limited Nos. may be kept for use in event of failures.

Air Bellows fitment by shed / workshop is not feasible without special tools. When required, we may offer refurbishment facility at our works, against payment of cost of Air Bellow. To & fro freight charges will be to your account.

6. AIR SPRING INSTALLATION HEIGHT RECORD



DEMU / EMU / MAINLINE – TRAILER COACH



DEMU DPC / EMU – MOTOR COACH

Date	Coach Type & No.	Bogie No.	Location	Air Suspension Assy. No.	Installed Height at tare Deflated L (mm) R (mm)	Installed Height Inflated L (mm) R (mm)	Air Pressure Inflated	Clearance (*) (S)	Lateral Stop Clearance	Lateral Stop Thickness
Specified					≥ 225	$255 \pm 5 / - 0$	Max. 6 Bar	50	40 ± 2	20
			A1							
			A2							
			B1							
			B2							
			A1							
			A2							
			B1							
			B2							

RESISTOFLEX

ICF

USER

CHAPTER

4

INSPECTION REQUIREMENTS

<u>S.No.</u>	<u>Topic</u>	<u>Page Nos.</u>
1.	Maintenance of Air Springs	17
2.	Intervals between Inspections of Air Springs	18

1. MAINTENANCE OF AIR SPRINGS

- I. Continental **AIR SPRINGS** are, in principle, **MAINTENANCE FREE**.

The **OUTER COVERING** consists of a thin, age resistant, flexible chloroprene rubber cover which **IS RESISTANT** amongst other things to the influence of **WEATHER AND SEWERAGE** and to a large extent to **OIL**.

ABRASION through contact **WITH OTHER BOGIE ELEMENTS** extending into the confines of the Air Spring, through thrown up **GRAVEL AND SAND** and any damage of the airbag wall by **FOREIGN BODIES AND THE TRAPPING OF THESE BETWEEN THE BELLOWS WALL AND THE FITTING ELEMENTS MUST DEFINITELY BE AVOIDED**.

Heavier coatings of **DIRT OR MUD** on the airbags wall should be washed off using only water whenever the bogie is serviced.

Coatings of dirt on the surfaces of fitting elements which are in contact with the airbag wall should be removed either mechanically or with water ensuring that there is no damage to the airbag wall or metal surfaces.

Should any corrosion scars or roughness on the surfaces of the fitting elements which are in contact with the airbag wall be evident, they should be smoothed down.

- II. Small, localized items of damage on the outer cover such as small cracks or chafing marks, providing the top cord ply has not been damaged, are acceptable in the short term without impairing the functional performance.

DAMAGE TO THE CORD PLY for instance fraying of the fibres by chafing or severed threads **NECESSITATES THE IMMEDIATE REPLACEMENT OF THE AIR SPRING**.

- III. **CONTI AIR SPRINGS WITH 6 FABRIC PLIES ARE BURST PROOF IF ACCIDENTALLY PENETRATED. THE LOSS OF PRESSURE WILL BE SLOW AND STEADY THUS AVOIDING A SUDDEN RELEASE OF LOAD TO THE PRIMARY SUSPENSION (DERAILING SECURITY).**

- IV. If an Air Spring is selected appropriate to the effective service conditions and the rolling stock runs trouble-free there will not be any limitation of service life of the Air Spring by necessary wear and tear or loss of strength during the life of the vehicle.

2. INTERVALS BETWEEN INSPECTIONS OF AIR SPRINGS

1. AIR SPRINGS ARE EXPECTED TO HAVE A SERVICE LIFE OF 16 YEARS. THIS IS EQUIVALENT TO HALF THE SERVICE LIFE OF THE BOGIE (32 YEARS).
2. Major inspections have to be carried out at certain intervals on rolling stock, for example, **WAGONS OPERATING ON SUBURBAN ROUTES SHOULD BE INSPECTED EVERY 4 YEARS**, but this inspection may be delayed by one year on two consecutive years, if the general state of the wagon would suggest that an inspection is not absolutely necessary after 4 years. In this case the longest interval between major inspections could be extended to a maximum of 6 years.

- 2.1 In view of their annual mileage (550 000 700 000 Km), **WAGONS OPERATING ON INTERCITY ROUTES MUST BE INSPECTED** more frequently, namely approx. **EVERY 1.5 YEARS**.

During the major inspections (Point 2.1 the Air Springs are subjected to a visual check (ageing and ozone cracking, damage caused by external influences). If necessary they may be removed for closer examination, but this is not the normal procedure.

- 2.2 **AIR SPRINGS ARE TO BE REMOVED FOR THE 2ND INSPECTION TO UNDERGO A VISUAL CHECK, BUT SPRING PROPERTIES ARE NOT TESTED.**

- 2.3 According to the latest edition of the German Railway construction and Operating Regulations the first scheduled inspection of wagons used as passenger trains, but not in intercity service, is due after 6 years, although this may be delayed by one year on two consecutive year.

We would like to point out that in principle the above intervals of time can elapse between inspections of Continental Air Springs. However, the second major inspection should continue to be carried out after a maximum of 6 years.

- 2.4 The details listed under 2.1 to 2.3 above are based on statements issued by the German Federal Railways or from the international governing body "Union Internationale des Chemins de Fers".

It should also be noted that according to the experience gained by the German Federal Railways, there is no need to replace Continental Air Springs prematurely.

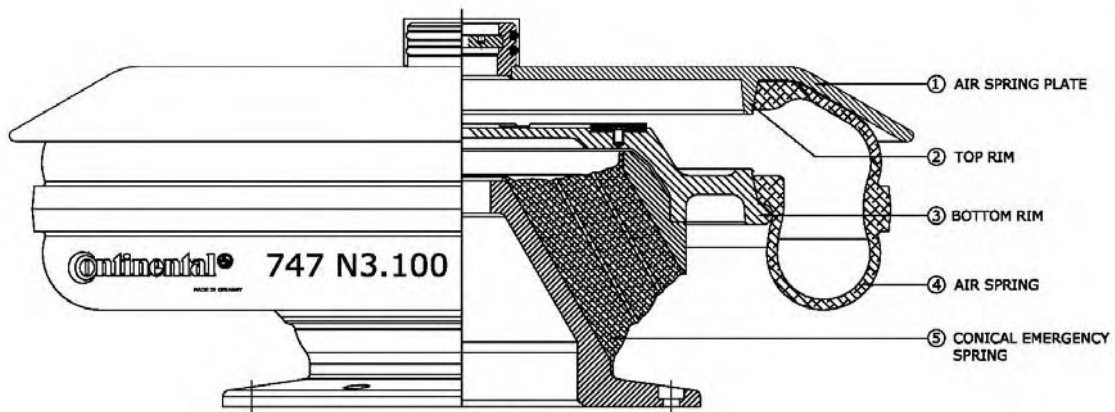
CHAPTER

5

TROUBLESHOOTING

<u>S.No.</u>	<u>Topic</u>	<u>Page Nos.</u>
1.	General Aspects	20 – 21
2.	Top and Bottom Sealing Surface Area	22
3.	Cracks Above or Below The Direct Belt Area	23
4.	Surface Damage In The Top Shoulder Area	24
5.	Chafing or Damage By Cutting	25
6.	Foreign Bodies, Chafing Or Damage By Cuts	25 – 26
7.	Peeling Of The Outer Rubber (Outer Cover Layer)	26

JUDGMENT CRITERIA FOR A POSSIBLE DEFECT PATTERN ON AIR SPRINGS FOR RAIL VEHICLES ARISING THROUGH EXTERNAL EFFECT



1. GENERAL ASPECTS

During their period of utilization in the vehicle Air Springs are subject to varyingly high external mechanical (12) and internal natural loads (1.1). If these lead to failures of the reinforcement structure or damage in the sealing surface area, it may lead to functional deterioration or the functional failure of the Air Springs. In order to give the user the possibility of being able to recognize and assess damage himself and where necessary introduce countermeasures, the main possible causes and effects are described hereinafter.

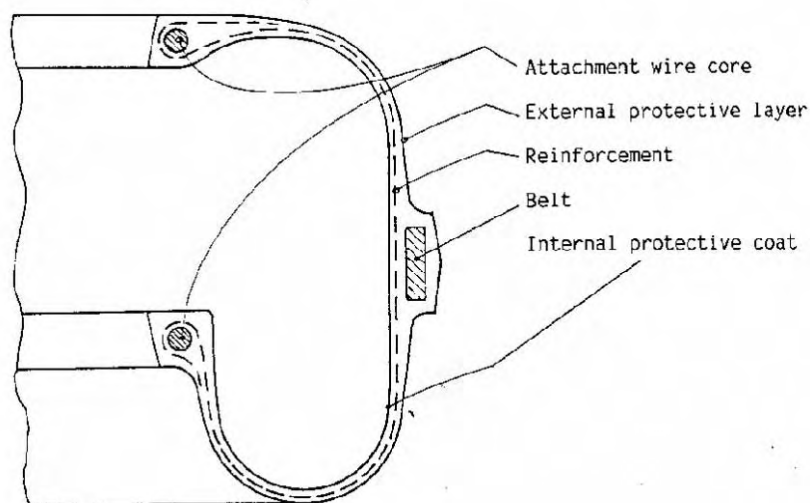
It should be mentioned that this description is based on long experience and intensive collaboration with manufacturers and operators of rail vehicles. It is recommended that in instances of doubt you should check back with the manufacturer.

- 1.1 Internal Natural Loads of and Air Spring : Air Springs are highly stressed spring elements, which are designed with regard to service life and bursting pressure protection are designed in such a way that they satisfy the demands of the Technical Delivery Conditions (Z.BTL 91843 of the German Railways) of different operators with rail vehicles. So in general it may be assumed that Air Springs under normal operating conditions with regard to service life fulfill the condition La 16 years, that is to say half the service life of the bogie. However, the prerequisite is that before being put into service or in the event of possible changing of the Air Springs the storage specifications be observed and during operation undue stresses be avoided (See Appendices 2 and 3).

That is to say that **WITH DISTURBANCE-FREE OPERATION THE SERVICE LIFE IS NOT LIMITED BY WEAR AND TEAR OR ANY REDUCTION IN STRENGTH. POSSIBLE SLIGHT, SHORT OZONE OR AGEING CRACKS, EXPOSE THE FABRIC STRUCTURE, MAY BE ACCEPTED AT ONCE, BUT SHALL BE OBSERVED IN SUBSEQUENT INSPECTIONS.**

1.2 External loads

1.2.1 BASIC STRUCTURE OF AN AIR SPRING



1.2.2. Functional description of the structural elements

Attachment wire core : Steel wire guarantees stable seating of the sealing bead on the rim and sealing of the Air Spring plate or piston.

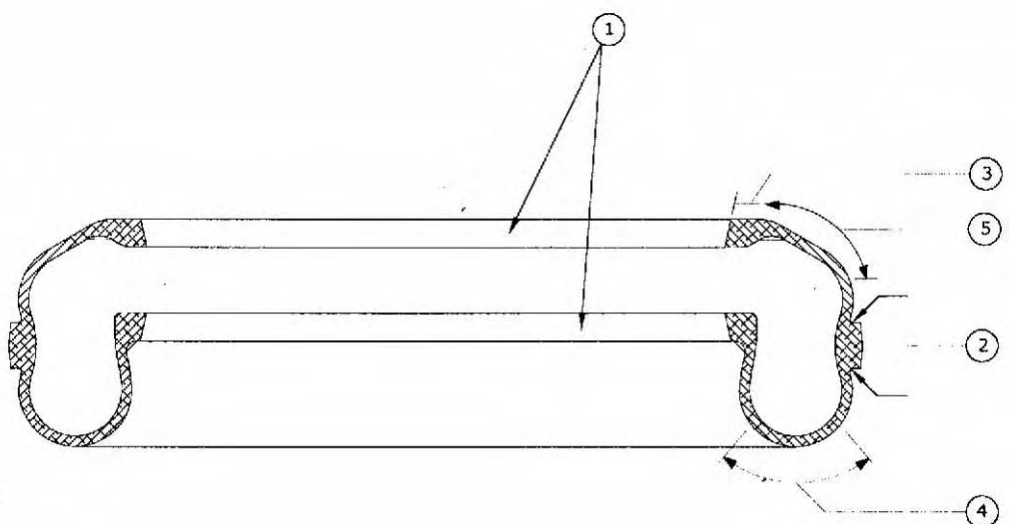
External Protective Coat : 100% highly flexible neoprene protection against the effects of the weather, faces and extensively against oil.

Reinforcement : Polyamide fabric guarantees operation, bursting pressure protection and service life.

Belt : Specific functional element.

Internal cover coat : 100% highly flexible neoprene guarantees sealing of the internal space of the Air Spring against atmosphere.

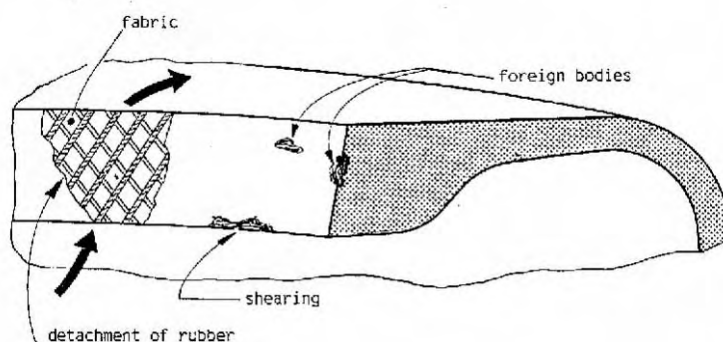
1.2.3 Description and judgment of possible damage zones :



2. TOP AND BOTTOM SEALING SURFACE AREA

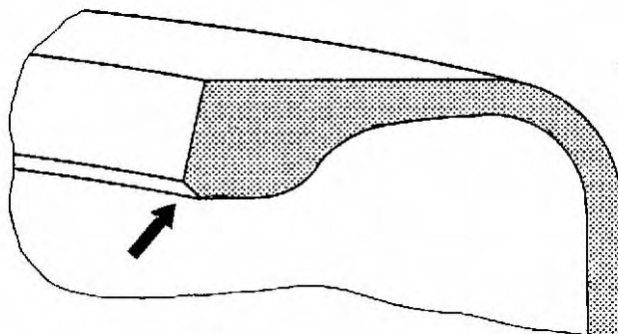
This area is extremely important for the operation of the Air Spring and is, amongst other things, checked by the works in the form of a 100% leak test. If the Air Spring is fitted properly, then there is no possibility of damaging this area through undue mechanical, also external stress. If nonetheless during the inspections traces are found of surface damage, then this may be **DUE TO** the following reason:

- a) **IMPROPER FITMENT**
- b) **IMPROPER DISMANTLING**
- c) **IMPROPER OR BAD STORAGE BEFORE PUTTING INTO SERVICE OR BETWEEN INSPECTIONS**

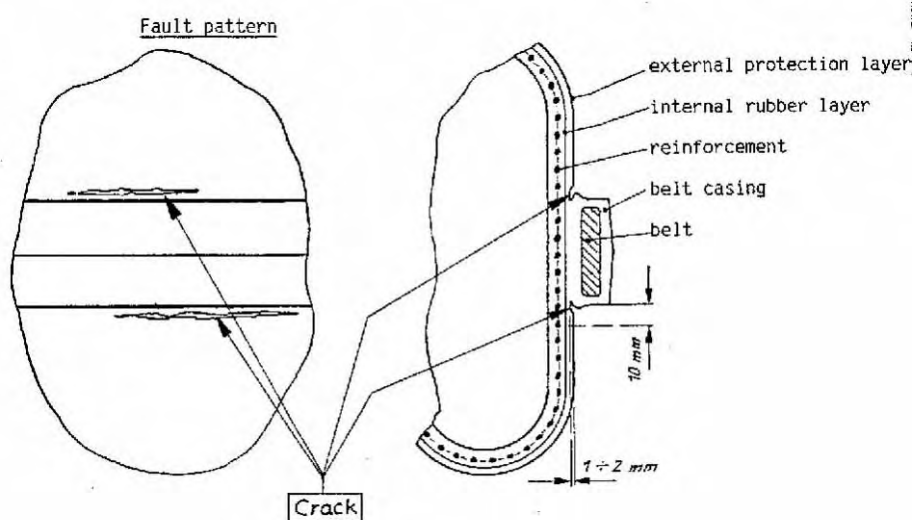


Detachment of rubber (by mechanical effect) or foreign bodies may lead to leaks. Air Springs of this kind may not be fitted anymore, since there is no longer any uniform radial sealing surface and there is a point of connection between the inner space and the ambient environment.
Uneven partial shearing may have been caused by prior dismantling of the Air Springs. This can in general be tolerated.

When assessing such a pattern it is however necessary to observe that the edges of the bead be partly chamfered by the works (depends on manufacture).



3. CRACKS ABOVE OR BELOW THE DIRECT BELT AREA

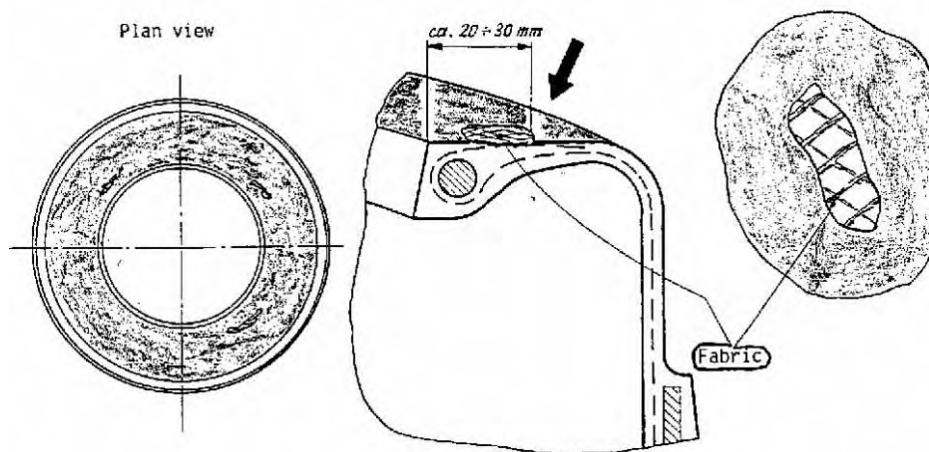


IF CRACKS OCCUR RADIALLY DURING OPERATION IN THIS AREA, THEN AIR SPRINGS OF THIS KIND SHOULD BE CHANGED ON THE NEXT INSPECTION. This surface damage has no functional effect on the Air Springs, or any effect which might prejudice their safety. Due to the structure, there can be neither damage to the reinforcement nor peeling of the belt nor any reduction in bursting pressure.

Cracks of this kind may after the time at which they occur “grow” radially; with respect to the depth however they simply move to the middle of the belt and not in the direction of the reinforcement.

This defect pattern may be triggered by different causes, for example extreme horizontal bellows wall deformations, damage by cutting due to external effects (ballast). Possibly, where there is doubt it may be necessary to bring in the manufacturer to obtain an assessment.

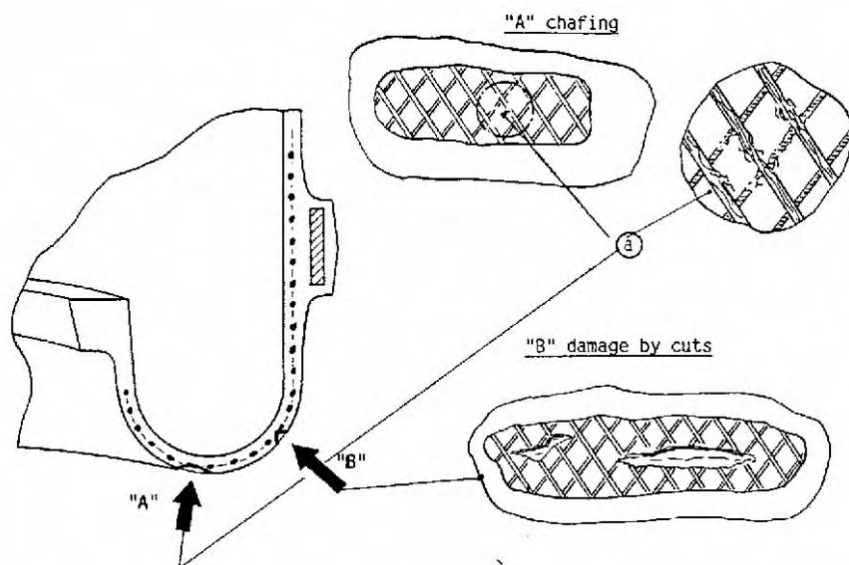
4. SURFACE DAMAGE IN THE TOP SHOULDER AREA



In many cases during inspection intervals or afterwards Air Springs are changed and released from the top Air Spring plate. If this is not done properly it could lead to surface damage through the use of the necessary tool, which could even penetrate as far as the reinforcement. Due to the structure there is not immediate safety-reducing damage, only if several threads of the individual layers (4-6) are pierced, may there under certain circumstances be an immediate functional failure.

IMMEDIATE CHANGING IS HOWEVER NECESSARY.

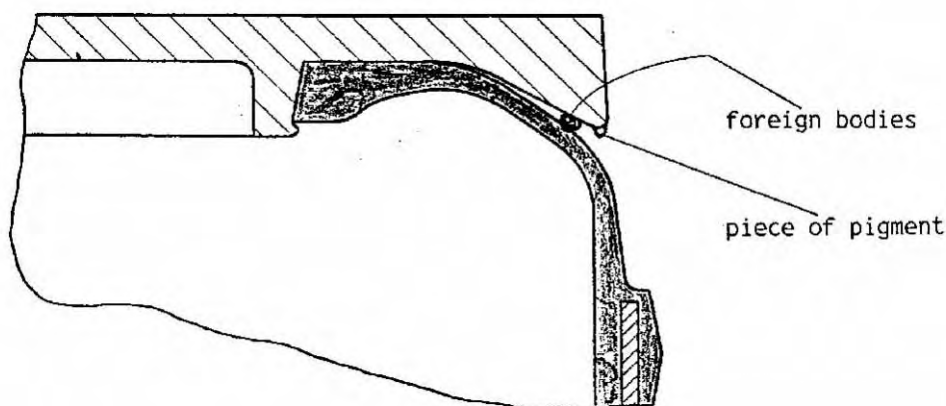
5. CHAFING OR DAMAGE BY CUTTING



Points of chafing or **DAMAGE BY CUTS**, caused by design attachment elements, hose connections or **BALLAST ACCELERATED** with an unusually high intensity may by experience occur in this area or also in the area (5). **ABRASION OR SHORT CRACKS ON THE TOP COVER LAYER MAY BE TOLERATED. IF HOWEVER, THE REINFORCING MATERIALS ARE EXPOSED, PIERCED AND / OR UNRAVELED (A), THEN THIS AIR SPRING MUST BE CHANGED AT ONCE.**

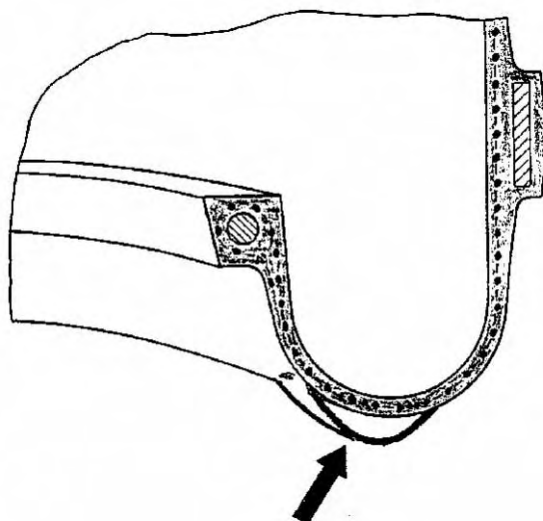
6. FOREIGN BODIES, CHAFING OR DAMAGE BY CUTS

For this area the same procedure applies to chafing and damage by cuts as in area (4).



If foreign bodies have got between Air Spring plate and bellows wall and have ended up jammed, these must be removed. **IF FABRIC IS ALREADY EXPOSED OR DAMAGED** (see point 4), **THIS AIR SPRING MUST BE CHANGED**. The same effect may also be produced by what are called "pieces of pigment", which may occur when the surface protection is applied. Unevennesses of this kind on the Air Spring plate or indeed on any other points of contact between the bellows wall and the metal part must be removed at once.

7. PEELING OF THE OUTER RUBBER (OUTER COVER LAYER)



During the time of utilization if any unevenness of the surface occurs in the form of a partial raising, this is to be **ATTRIBUTED IN MOST CASES TO INCORRECT STORAGE OR INTERIM STORAGE TOGETHER WITH LONG-TERM CONTACT WITH OIL. CHANGING IS NECESSARY.**

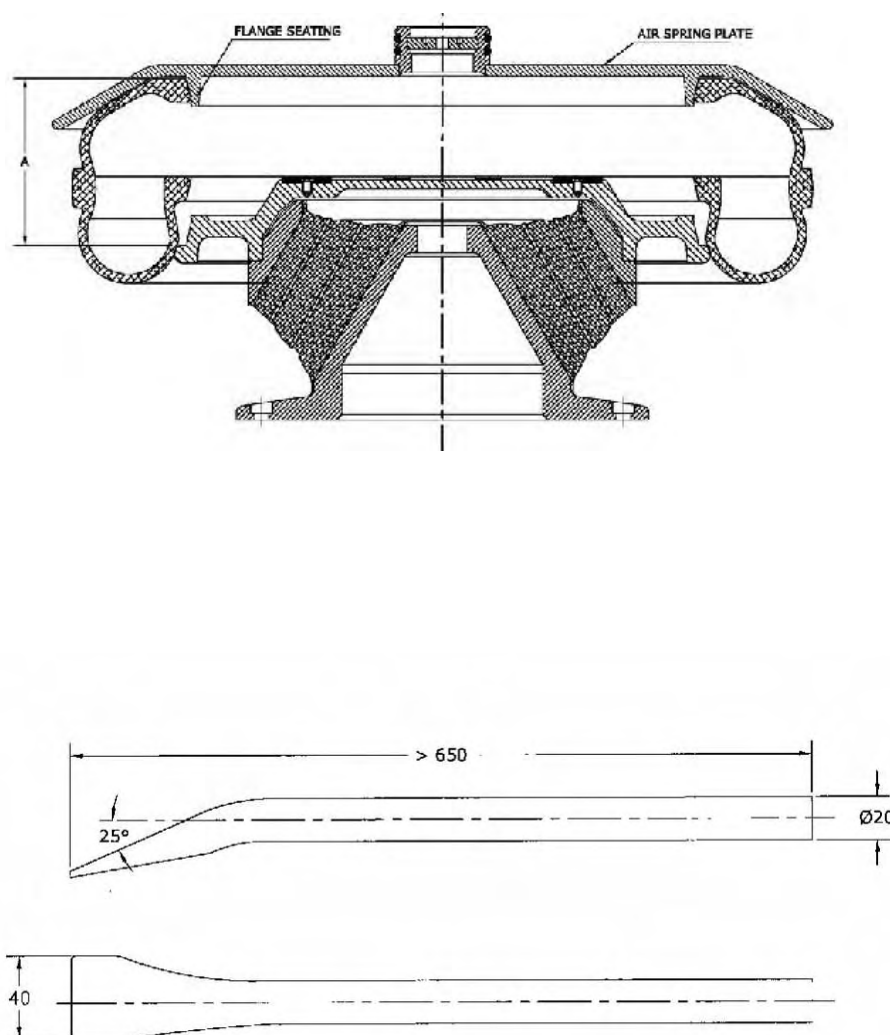
CHAPTER

6

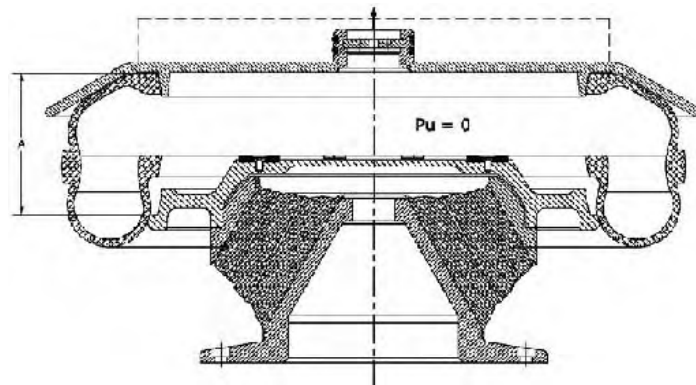
INSTRUCTIONS FOR REMOVALS OF AIR SPRING

Instructions for removing Air Springs with a clamping projection on the table top

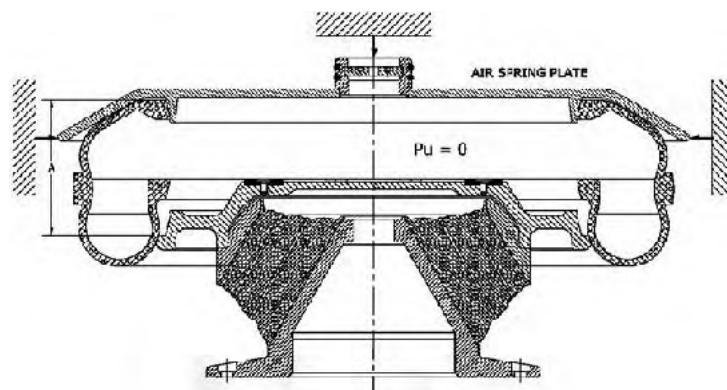
In certain circumstances the clamping projection which facilitates the exact fixing of the bead may hinder the removing process.



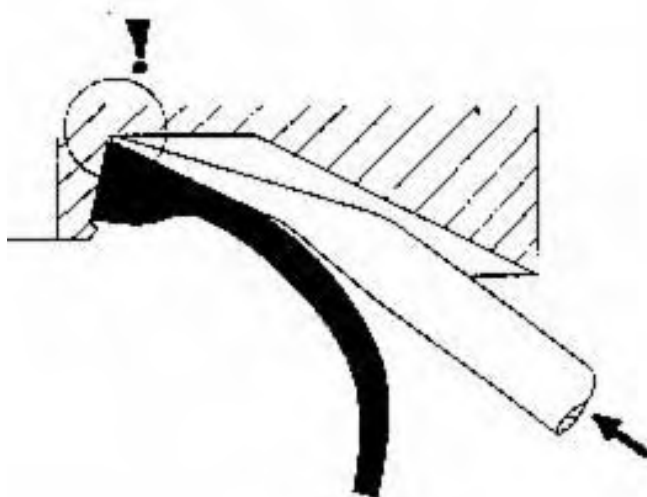
To obviate damage to or even the destruction of the bead when removing the top plate, the following procedure is recommended.



1. Increase the top plate distance A as much as possible while air spring is in the unflated state.

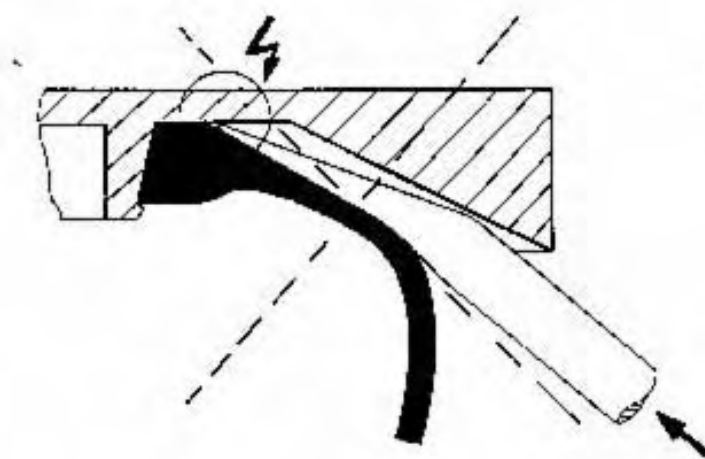


2. Fix top plate in this extreme position so that it does not exert any pressure on the Air Spring.

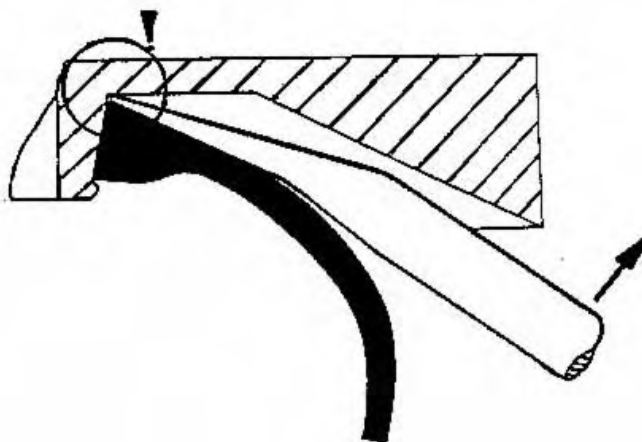


3. Force in assembly lever until it touches the metal cone whereby the lever`s concave side should be against the air spring`s wall.

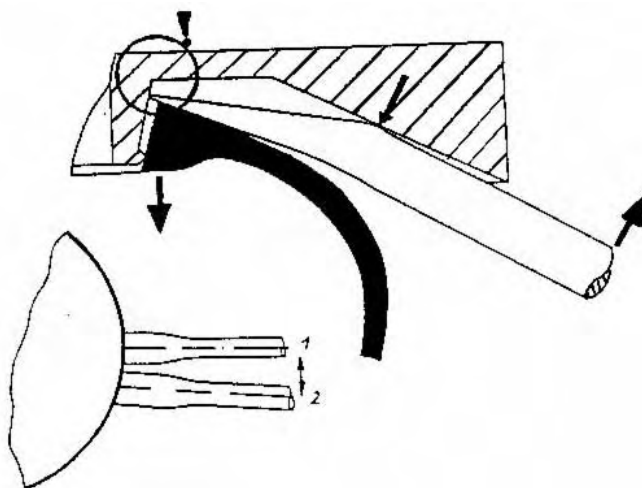
It is important to ensure that the lever is pushed between top plate and air spring`s wall until it touches the flange.



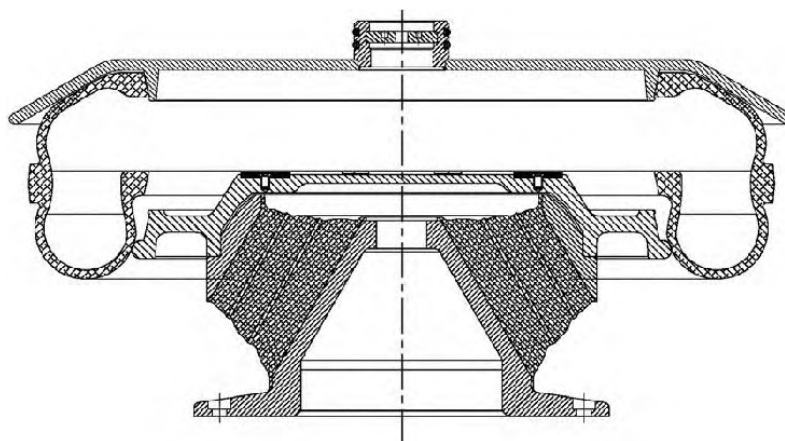
If assembly lever is not in contact with the cone there is a danger of the spring being destroyed or it may prove impossible to unseat it.



4. Force spring bead from flange seat by making an upward movement of the lever and using the air spring`s supporting edge as pivot.



5. If necessary, shift lever by a spoon`s width along flange circumference and repeat action. (Pos. 2)



6. Air spring partially comes off flange seating and can then easily be removed completely from the air spring plate.

CHAPTER

7

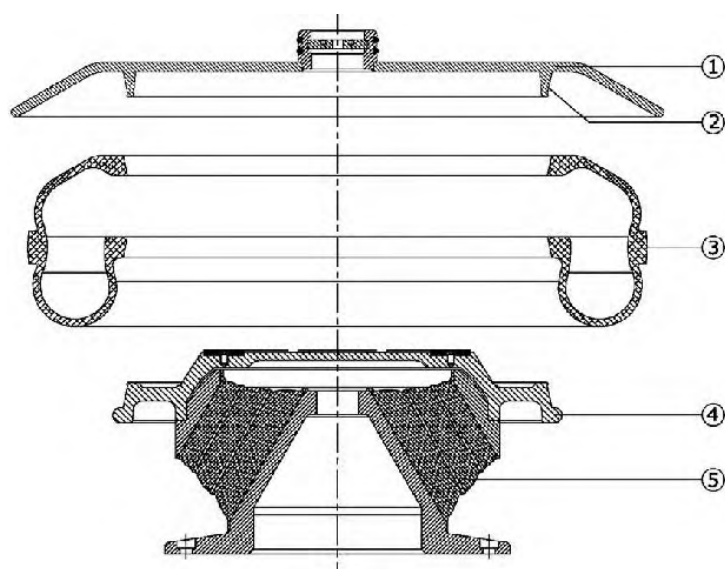
INSTRUCTIONS FOR
INSTALLING AIR SPRINGS
(TYPE : BELTED AIR SPRINGS)
WITH HOLDING LIP ON THE
UPPER AIR SPRING PLATE

<u>S.No.</u>	<u>Topic</u>	<u>Page Nos.</u>
A.	Tools and Components	33
B.	Installation	34 - 38

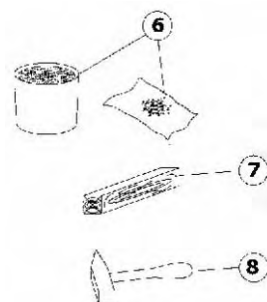
The following instructions for installing Conti Belted Air Springs are mainly confined to explaining the assembly of AIR SPRING and MOUNTING HARDWARE.

It may be necessary to change the order of assembly procedure in certain cases as different types of piston are used in terms of both seating the Air Spring and fixing the air spring plate to the rail car body.

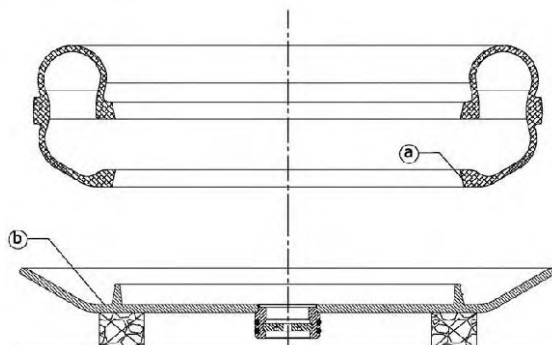
A) TOOLS AND COMPONENTS



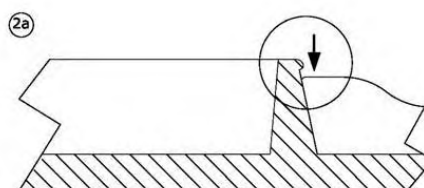
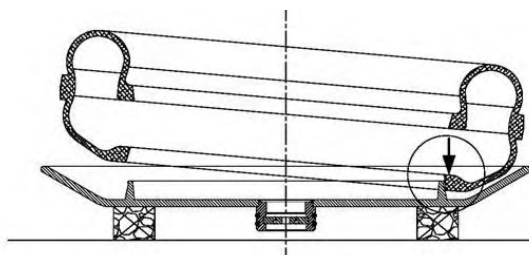
1. Air Spring Plate
2. Upper Rim
3. Air Spring
4. Lower Rim Plate
5. Piston
6. Water or soap suds and cloth
7. Piece of wood (approx. 40 x 20 x 400 mm)
8. Hammer



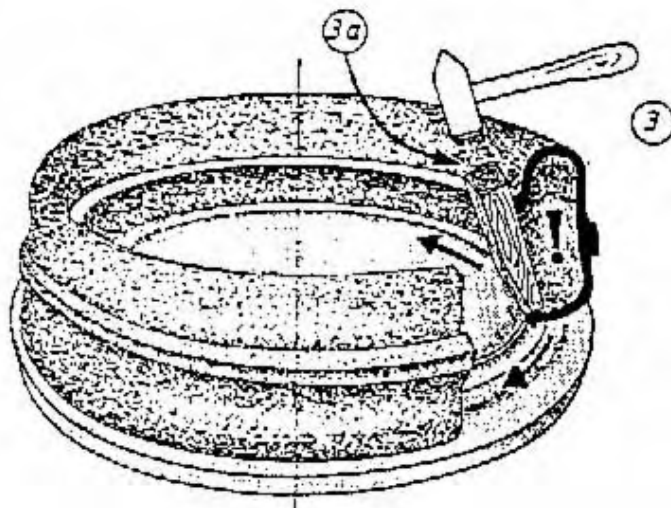
B) INSTALLATION



1. Clean the upper bead (a) and upper rim (b) using a cloth. The upper air spring plate is already in the illustrated (reversed) position.

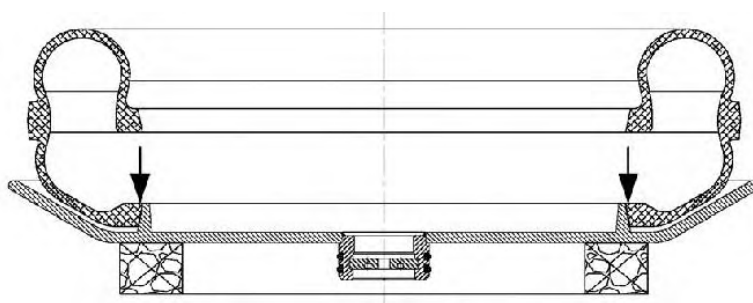


2. Locate and point of the Air Spring upper bead on the rim and press the bead behind (underneath) the upper lip. (Fig. 2a).

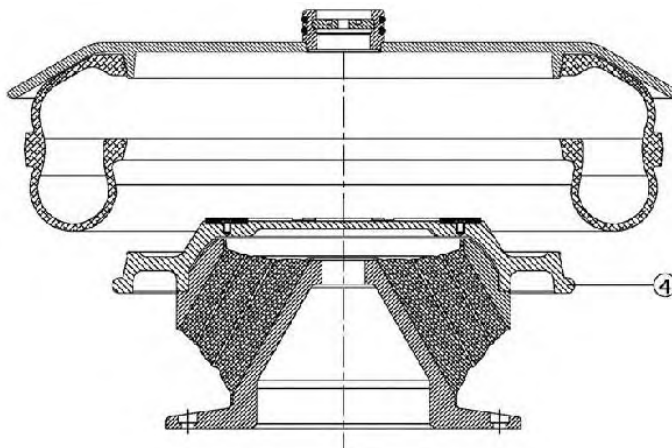


3. Plate a suitably sized piece of wood (3a) on the surface of the bead and, using a hammer tap the wire bead into position (3b).

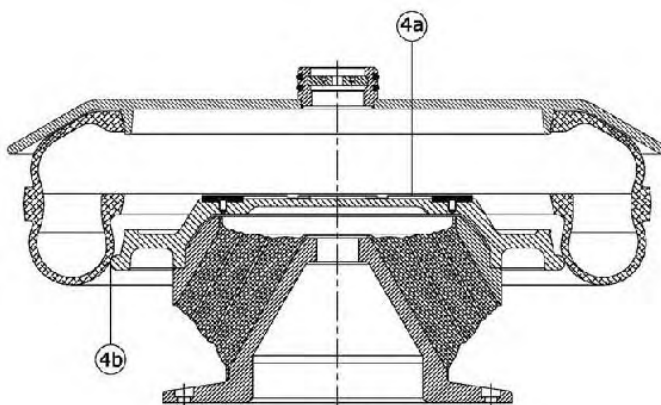
Note : Working away from the starting point radially, tap evenly at increasing distances to the left and right (!) until the bead has slipped under the holding lip around its entire circumference.



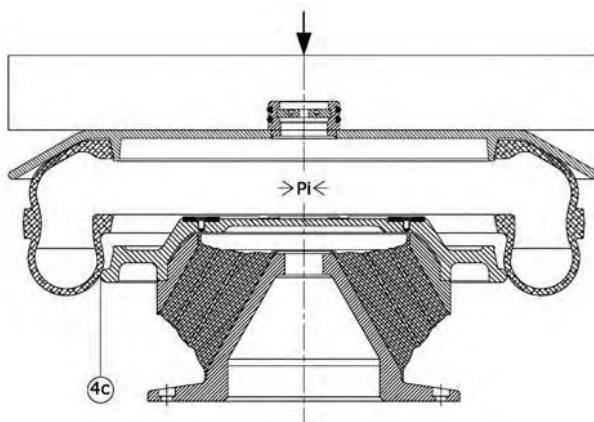
The Air Spring is now properly connected to its air spring plate.



4. The final step is to now fit the Air Spring to the lower rim (4). To do so, it is sufficient to place the Air Spring on the rim so that the bead area is positioned parallel to the rim.

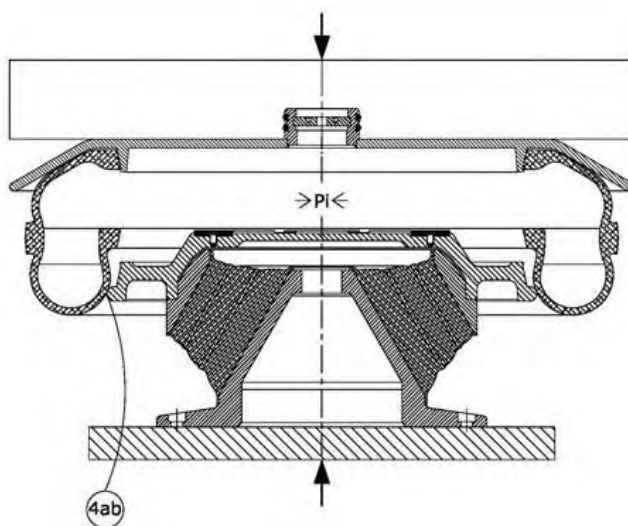


Clean both the bead area of the Air Spring (4a) and the sealing areas of the rim (4b) beforehand. It is recommended that this area is moistened with water or soap suds to make installation easier.



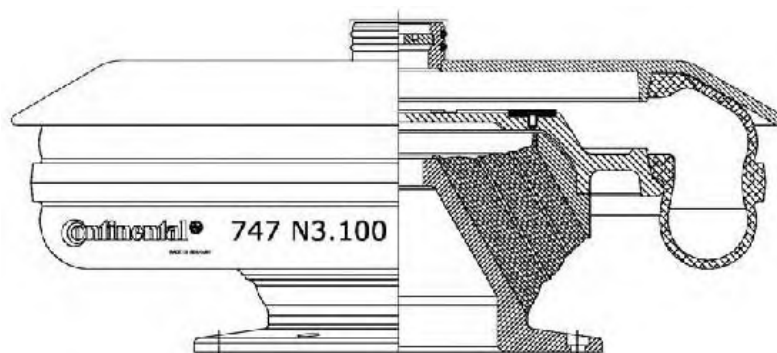
- 4.1 If the Air Spring is to be mounted directly onto the bogie, the bolster or transom can now be applied. If the rail car body is to be fitted afterwards or if technical approval of the bogie under load is to be conducted, the bead area of the Air Spring is brought into position (4c) to guarantee a tight seal.

The sealing area 4a and 4b must however be cleaned beforehand.



- 4.2 If you intending to fit the whole Air Spring System as a unit later into the bogie, this can be done by means of a suitable device. The type of device used is illustrated on page 5.

After cleaning and moistening the sealing area (4a /b) the Air Spring can be inflated at a spring internal pressure of $p = 6$ bar.

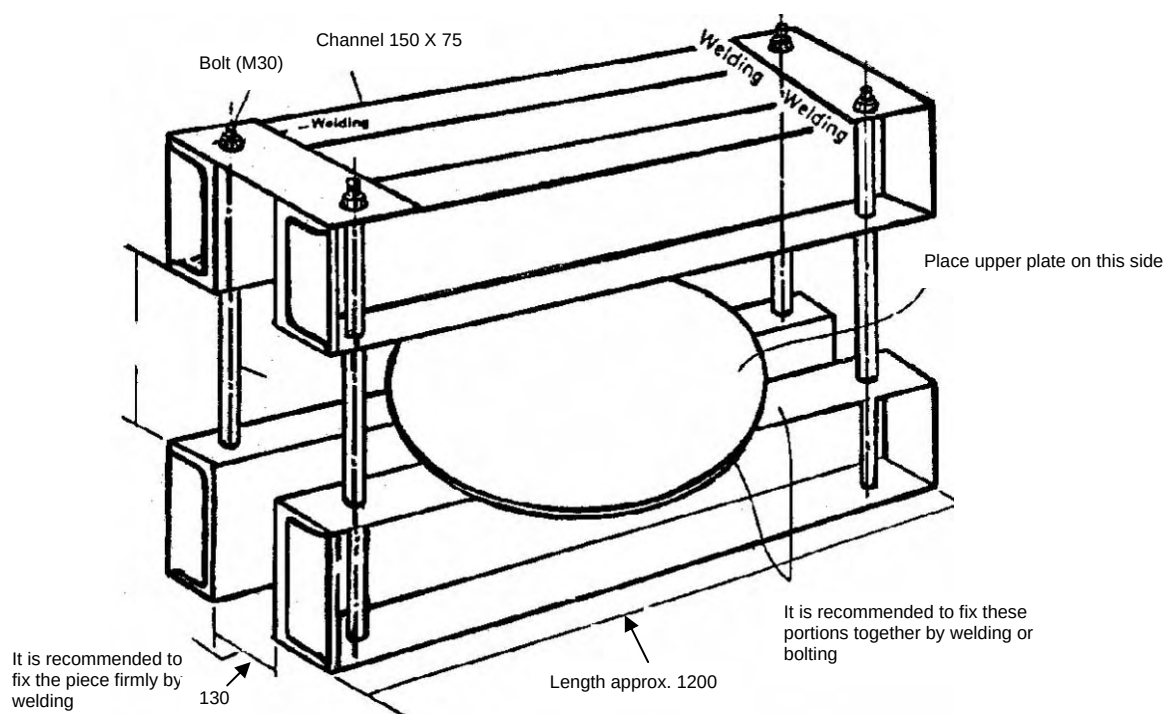


The Air Spring is now fully installed.

Note : All Conti Air Springs undergo a 100% airtightness test. However, for early detection of any errors or irregularities during installation which may lead to leakages, we recommend conducting an airtightness test once installation has been completed.

Airtightness Testing Device

Illustration of the principle



CHAPTER

8

**AIR SPRINGS
&
RUBBER PRODUCTS
REQUIREMENTS FOR STORAGE,
CLEANING AND MAINTENANCE**

<u>S.No.</u>	<u>Topic</u>	<u>Page Nos.</u>
1.	Scope	40
2.	General	40
3.	Store Room	40 - 42
4.	Storage and Handling	42
5.	Cleaning and Maintenance	43

1. SCOPE

- 1.1 These directions apply to products of rubber in the pure form of combined with other materials, namely to elastomers of natural rubber and / or synthetic rubber as well as to unvulcanized rubber compounds, adhesives and solutions with rubber.
- 1.2 The directions in Sections 3 & 4 apply principally as requirements for long-term storage (in general more than 6 months).

For short-term storage (less than 6 months) for example in production or supplier's stores where stocks are continually being drawn upon the provisions of this Standard, apart from the general requirements in relation to the storage rooms in Sections 3 and 3.1, apply as appropriate provided the appearance and performance of the products do not thereby suffer any detrimental alteration (see however Section 4.2.1 b).

2. GENERAL

Under unfavourable storage conditions or with inappropriate handling, most rubber products change their physical properties. This can cause a reduction in service life and they may for example become unserviceable due to excessive hardening, softening, permanent deformation or as a result of flaking, cracking or other surface damage. Such changes may for example result from the effects of oxygen, ozone, heat, light, humidity, solvents or from storage under stress. Properly stored and handled rubber products will retain their properties virtually unchanged over long periods (some years). This however does not apply to unvulcanized rubber compounds.

3. STORE ROOM

The store room should be cool, dry, free from dust and moderately ventilated. Outdoor storage with protection against weathering is not permitted.

3.1 Temperature

The storage temperature for products made of rubber depends on the goods in question and the elastomers used.

Rubber products should not be stored at temperature below 10°C and above +15°C, whereby the upper limit may be exceeded up to +25°C.⁰ Any temperatures above this are only permissible for a short period.

Deviations to this rule can be rubber products made of certain types of rubber e.g. chloroprene rubber, where the required storage temperature may not be lower than +12°C.

3.2 Heating

Rubber products stored in heated store rooms must be shielded from the source of heat. The distance between the source of heat and the stored goods must be at least 1 m. A greater distance is required in the case of rooms heated by blast heating apparatus.

3.3 Humidity

Storage of rubber products in damp store rooms should be avoided. Care must be taken to ensure that no condensation occurs. The relative humidity should preferably be below 65%.

3.4 Lighting

The goods should be protected from light, in particular from direct sunlight and strong artificial light with high ultra-violet content. For this reason the windows of store rooms are to be covered with a red or orange (never blue) protective coating. Room lighting with ordinary incandescent bulbs is preferable.

3.5 Oxygen and ozone

Rubber products should be protected from air changes, above all from draughts, by wrapping, by storing in airtight containers or by other means. This applies in particular to articles with a large surface to volume ratio, e.g. rubberized fabrics or cellular rubber articles.

As ozone is particularly harmful, store rooms should not contain any equipment generating ozone, such as electric motors or other equipment, which may produce sparks or other electrical discharges. Combustion gases and vapours which may produce ozone via photo chemical processes should be removed from the store room.

3.6 Miscellaneous

Solvents, fuels, lubricating agents, chemicals, acids, disinfectants, etc. may not be stored in the store room.

4. STORAGE AND HANDLING

4.1 General

Care should be taken to ensure that the rubber products are stored in an unstressed condition, i.e. without tension, pressure or other deformation since stressing not only promotes permanent deformation but also crack formation. (O-ring seals for instance are not to be stored hanging on hooks). Certain metals, particularly copper and manganese, have a harmful effect on rubber products. For this reason, such products should not be stored in contact with these metals but should be protected by wrapping or sealing with a layer of suitable material e.g. antistatic sheeting or bags made of paper, polyethylene or polyamides (nylon).

The material used for storage containers, wrapping and covering purposes may not contain any components which are harmful to the products e.g. copper or copper-containing plasticizers must not be used for wrapping.

If rubber products are dusted, the dusting powder should be free from components harmful to the products. Suitable materials for dusting are talcum, whiting, finely ground mica powder and rice starch.

Contact between rubber products of different composition should be avoided. This particularly applies to rubber products of different colours.

Rubber products should remain in store for as short a time as possible. In the event of long-term storage, care should be taken to ensure that newly delivered products are stored separately from those already in store.

5. CLEANING AND MAINTENANCE

Rubber products can be cleaned with soap and warm water. The cleaned articles should be dried at room temperature. After a fairly long period of storage (6 to 8 months) the products can be cleaned with a 1.5% sodium bicarbonate solution. Remaining traces of the cleaning fluid should be rinsed off with water. The manufacturer will recommend effective and particularly harmless cleaning agents.

Solvents such as trichloroethylene, carbon tetrachloride as well as hydrocarbons must not be used for cleaning purposes. Moreover, sharp-edged objects, wire brushes, emery paper etc. should not be used.

Rubber-metal bondings are to be cleaned using a glycerine-spirit mixture (1:10).